NSLS-II Accelerator Systems Advisory Committee (ASAC)

Report of the 5th meeting, March 26-27, 2009

Committee Members Present:

C. Bocchetta, Instrumentation Technology
G. Decker, APS
D. Einfeld, ALBA
J. Galayda, SLAC (Acting Chair)
D. Rubin, Cornell
C. Steier, LBNL

The committee expresses appreciation for the impressive work done to date and the effort evident in the presentations. The committee also expresses appreciation to the NSLS-II administrative staff for the very good organization of review logistics.

For this review, the Committee focused on addressing the seven points of the charge:

- *Review the results on dynamic aperture studies, including the effect of insertion devices, and provide assessment on proposed improvement for the non-linear and chromatic correction system*

Significant progress has been made. The effect of damping wigglers and insertion devices has been studied in tracking. The effect of an EPU was noticeable and suggests that more effort must be put into specifications for these EPU magnets and damping wigglers as well. Some attractive options for adding a chromatic knob were described. The Project is near a final decision about how or if a third chromatic knob is implemented.

Recommendations:

-Review achieved precision of BPM location by means of BBA, and introduce realistic errors into the orbit and optics correction model

-Organize an in-depth workshop/review of the storage ring lattice and tracking results in the near future

-Investigate the performance of the Storage Ring lattice at higher positive values of vertical chromaticity, which are generally required to control instabilities.

- *Review the progress on design of the injector system and comment on procurement plans for major components in the near future*

The committee heard reports on linac design and booster lattice design. Alternative booster lattices are still under consideration. The booster design must be much better defined before one can comfortably go out to procure to performance specifications. The committee endorses the suggestion mentioned in the presentations, that some consideration be given to in-house construction.

The committee received a very brief overview of injection diagnostics, and did not have a chance to assemble an informed opinion. There appear to be no loss monitors listed for the booster.

The tolerances on injection bumps are extremely tight, as a result of applying orbit stability criteria to the entire injection process. The option of pulsed sextupole injection was discussed. This looks attractive. It may be possible to modify the geometry of the pulsed magnets, distorting the conductors from pure 120 degree rotational symmetry in order to achieve a better pulse magnet design.

- *Review the results from the Storage Ring magnet prototype program with respect to readiness to start the production within the next few months.*

Prototyping has gone very well, and the magnet designs appear to be mature and carefully tested. The procurement strategy of "build to spec" is workable. This strategy favors bidders with prior experience building just these sorts of magnets. It will be important to place emphasis on such experience in selecting awardees. It is important to distinguish between a company's past jobs and the presence of experienced experts on staff.

The contract must emphasize thorough testing of first articles prior to direction to proceed. NSLS-II should consider addition of a contract clause to permit termination for convenience part way through a production run, in the event of a non-performing vendor.

The committee feels strongly that all magnets should be fully measured at BNL after delivery.

- *Review the progress of the vacuum system and in particular assess the shielded bellow design and mitigation of beam heating issues of the vacuum system.*

NSLS-II has considered designs developed at other labs, and evaluated alternative finger designs. A model of a bellows liner was shown, that had wide thick plates. The committee suggests that the ALS design be examined. It has no sliding contacts. A small loss factor does not guarantee that high RF fields cannot build up between liner and bellows. The wide plate design should be checked for this possibility.

The short-circuit shields in the pumping slots may be an attractive option for getting rid of the TE modes that can plague RFBPMs. Of course care must be taken to ensure that the shields are not touched by the NEG strips or by synchrotron radiation.

NSLS-II presented a single flange BPM design with enhanced conductive cooling of buttons. This appears to be a nice solution of the button heating problem.

- *Review the superconducting cavity designs and procurement strategies for the RF systems*

The LLRF work is well-advanced for this stage of the Project. The NSLS II RF group has determined that superconducting RF is the best choice for accelerating cavities and the committee concurs. The CESR-B (500MHz) cavity and the KEK-B (508MHz) are candidates for the RF system in NSLS II. Both cavities would require some modification. The input coupling of the CESR-B cavity would need to be increased due to the heavy beam loading in NSLS II. That would require modification of the waveguide to cavity

coupling hole and tongue, or alternatively implementation of some kind of waveguide transformer. The resonant frequency of the KEK-B cavity is a bit high. Presumably it could be made to work by suitably scaling all of the dimensions or by other modification of the cavity geometry. Either way, NSLS II will end up with a new design. The committee notes that even subtle changes in cavity geometry can lead to significant changes in cavity performance and in particular multipactor behavior.

Recommendations:

The Project should plan on performing a cold test of the new SCRF cavity before it is built into its cryostat.

Make an effort to decrease R/Q of the passive cavity.

• *Review the development of the control system with particular attention to the definition of interfaces between controls and technical subsystems.*

The controls system staffing has increased. This is encouraging. The fast communication scheme for real-time feedback looks very good, and will find application in many accelerators requiring fast, synchronous global control algorithms. The committee feels that supporting great diversity in high-level applications is good to a point. Diversity can lead to dilution of effort and less-than-ideal support of the essential applications. The committee suggests that support of high level applications standards be prioritized to ensure that the essentials get very reliable support.

The controls group must get involved in the injector procurement to be sure that the awardees deliver a compatible controls system.

• *Review the major procurement plans and comment on procurement strategies and assumptions made for the procurement schedule.*

A dedicated procurement group is commendable and indeed essential.

The commitment to award 4 months after RFP on major contracts is impressive. Staffing looks adequate but change orders from civil construction can create very heavy burst loads on procurement. Procurement experience with civil construction is in particular important to handle this workload.

Keep focus on rapid staff-up. Look for resources at other labs.

Give serious consideration to parallel awards and “easy” escape clauses in contracts for magnets, to facilitate a shift of scope from one vendor (who might not be performing satisfactorily) to another.

At next review the committee would like to hear

-An overview of front end design as affects top-up and x-ray diagnostics

-Beam containment and top-up planning in more detail

-Machine protection

-X-ray diagnostics as related to machine commissioning and operation

-Insertion device update

-Update on injection system, including storage ring injection kickers and top-up.